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NOTES ON GEOGRAPHIC DISTRIBUTION

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Amauroderma trichodermatum (Ganodermataceae, Basidiomycota): first record from Bolivia and geographic distribution map, with notes on nomenclature and morphology

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Abstract: *Amauroderma trichodermatum* is reported from Bolivia, the collection being the fourth one known worldwide. The species is unique in the genus by having a hirsute pileus and a monomitic hyphal system. The use of the epithet "*trichodermatum*" as a correction for the typographical error "*trichodematum*" is proposed. A description and illustrations are provided based on the fresh Bolivian specimen, which has been compared with the type.

Key words: Amazonia, Bolivia, Neotropical polypores, rare species, South America

Amauroderma trichodermatum J.S. Furtado is an intriguing and enigmatic species in the genus due to its particularly hairy pilear surface and its rarity. The species was described from northeastern Brazil in the 1960s based on a thirty-year-old specimen (Furtado 1968). Another 33 years would pass before it was again reported by Ryvarden and Iturriaga (2001) with only three additional records since (Table 1). During a survey of Neotropical polypores of the Bolivian Amazon, we found a striking, *Polyporus*-like basidiome, arising from the ground with a strongly hispid to hirsute, concentrically zoned pileus. Microscopic analysis revealed the presence of ganodermatoid, non-truncated basidiospores indicating *Amauroderma trichodermatum*. Its identity was confirmed by macro and microscopical comparison with the type specimen of *A. trichodermatum*.

Examined specimens are kept at LPB and SP; herbarium acronyms are according to Thiers (2015, continuously updated). Macroscopic features are described from fresh and dried specimens. Microscopic features were observed on freehand sections mounted in 3–5% KOH, phloxine 1%, Cotton Blue and Melzer's reagent.

The International Code of Nomenclature for algae, fungi and plants (McNeill et al. 2012) states in Art. 30.8 that publication in a thesis does not constitute an effective publication. *Amauroderma trichodermatum* was originally described by Furtado (1968) in his thesis "Revisão do genero *Amauroderma* (Polyporaceae). Estudos baseados nas microestruturas do basidiocarpo" and it could be considered, at first, as not validly published. However, Art. 30.8 also allows for exceptions if the thesis includes an explicit statement (referring to the requirements of the Code for effective publication) or other internal evidence that is regarded as an effective publication by its author or publisher. Furtado's thesis includes a list of 16 libraries of scientific institutions (in 16 different countries) to which a copy has been sent. This is sufficient to make his descriptions effectively and validly published (see Art. 29.1). Here we propose to use the epithet "*trichodermatum*" as a correction for the typographical error "*trichodematum*".

Table 1. South American records of *Amauroderma trichodermatum* on which the geographic distribution map is based. Herbarium acronyms are according to Thiers (2015, continuously updated).

Country **Province/State, Locality, *Voucher***	**Eco-region**	**Reference**
Bolivia		
La Paz, Madidi National Park, *L. Evans 74* LPB	Amazonia	**This work**
Brazil		
Pará state, Óbidos (**T**)	Amazonia	Furtado (1981)
Paraná state, Foz do Iguaçu, Iguaçu National Park, *IGa-2405* HFC.	Atlantic Rain forest	Ryvarden and De Meijer (2002)
Paraná state, Curitiba Piraquara and Mandirituba, *CUm-2148*, *Pld-2100* and *MANa-2624*, HFC, respectively	Atlantic Rain forest	Ryvarden and De Meijer (2002) (Three nearby locations marked with one dot on the map)
Guiana		
Pakaraima mountains, **n/d**	Guiana Highlands	Aime et al. (2003)
Venezuela		
Bolivar state, Gran Sabana, Aponwao, **n/d**	Orinoquia	Ryvarden and Iturriaga (2001)

T= holotype, **n/d**= no data,

Amauroderma trichodermatum J.S. Furtado. Figures 1–7, 11–15.

Rev. Gên. *Amauroderma* (Polyp.) Est. Bas. Microestr. Basid. 311. 1968.

HOLOTYPE: BRAZIL, Pará state, Mata do Curusambá, Óbidos, 15 November 1927, *P. Occhioni*, SP 102864!

MACROMORPHOLOGY: Basidiomata annual, pileate, slightly eccentrically stipitate; pileus circular (up to 11 cm in diam. in the type), mostly plane to slightly concave when fresh (Figures 1 and 2), applanate in cross section with margin strongly incurved upon drying (Figure 5). Pilear surface hispid to hirsute with dark brown to blackish hair-like elements distributed in concentric bands/zones of varying densities, resulting in shaggy, dense, dark brown zones that alternate with paler, more sparsely hairy ones (Figures 1 and 2). Margin acute, dark brown, with a thin, sterile concolorous zone on the pore surface. Pore surface snowy white when fresh, unchanging when touched or bruised (Figure 3); cream to pale yellowish-brown when dry. Pores angular, polygonal and radially arranged, 3–4 per mm, slightly elongated towards the stipe but not decurrent; dissepiment edges entire when fresh, very thin and slightly lacerate to denticulate when dry. Context cream to pale yellowish-brown when dry, floccose, up to 3 mm thick. The darkening of the context in the presence of KOH as mentioned by Furtado (1981) was not observed. Tube layer up to 3 mm long, resinous when dry and very friable, darker than the context. Stipe cylindrical, up to 8 cm long, 0.7 cm diam. towards the pileus, widening to 1 cm diameter at the base, covered with a dense, pale brown tomentum (Figure 6); context dense, with irregular, dark reddish-brown, resinous bands (Figure 6).

MICROMORPHOLOGY: The Bolivian specimen is quite immature and few basidiospores were observed; however they were in accordance with those of the type (Figure 9), which are globose to subglobose, 7–8 × 6–7.5 µm, hyaline to slightly yellowish, with a prominent and conspicuous apiculus (black arrow in Figure 9), acyanophilous and IKI-. The context is composed exclusively of hyaline to yellowish, clamped, generative hyphae, thick-walled but with a wide lumen and often collapsed (Figures 10 and 11). The same pattern is observed in the trama of the tubes, though those hyphae are embedded in a resinous matrix. Our observations differ from those of Furtado (1981) who reported a context with "... binding hyphae hyaline and subhyaline, thickened to subsolid (at the apices), 1–3 µm diam; skeletal hyphae hyaline or subhyaline, up to faintly yellowish, thin-walled to almost subsolid, 4–7 µm diam[eter]". Regarding the hair-like elements of the trichoderm, we could observe that, as stated by Furtado (1981), they are composed of clamped, thin- to thick-walled, yellowish-brown to brown hyphae (Figures 12–15). The structure of the stipe tomentum is similar, but the hyphae that constitute those hair-like elements are hyaline to yellowish. All hyphae are non-reactive with both Cotton Blue and Melzer's reagent.

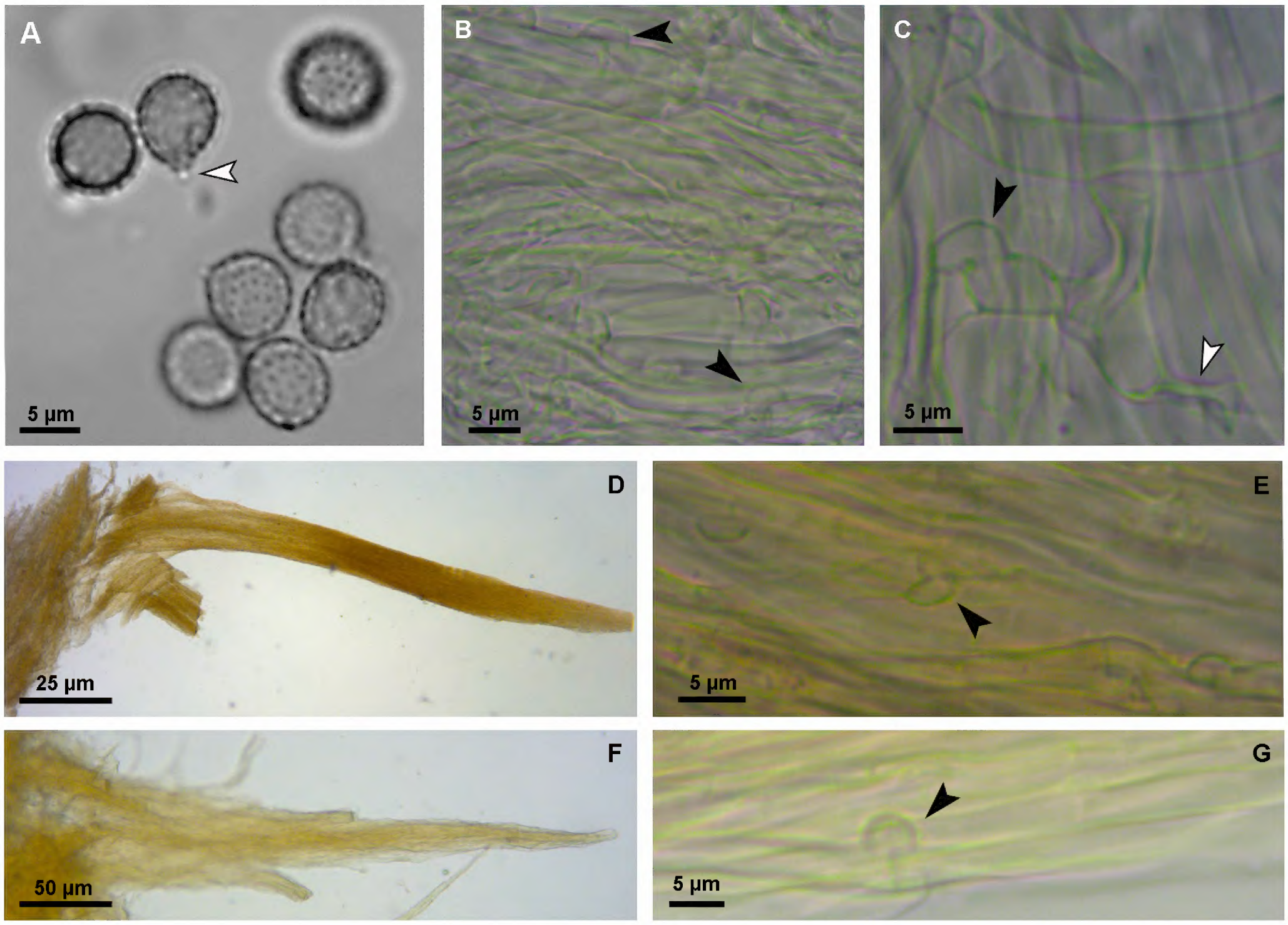
SPECIMENS EXAMINED: BOLIVIA, La Paz, Madidi National Park, Tuíchi river valley near "Chalalán" lagoon, on soil in a lowland Amazonian rain forest, January 2009, *L. Evans* 74 LPB. BRAZIL, Pará state, Mata do Curusambá, Óbidos, 15 November 1927, *P. Occhioni*, Holotype SP 102864.

GEOGRAPHIC DISTRIBUTION: Based on available literature (Table 1), a preliminary distribution map of *A. trichodermatum* is provided (Figure 16). So far the species is endemic to the Neotropical region, with five records corresponding to different humid ecoregions, all of them located within the Amazonian Domain. These few records suggest that the distribution of the species could extend beyond the Amazon, covering the entirety of Neotropical lowland rain forests, with the possible exception of the drier areas of the Brazilian Cerrado.

REMARKS: The characteristic pileus surface is by far the most diagnostic feature of *A. trichodermatatum*, rendering it difficult to confuse it with other species in the genus. The monomitic structure seen in the

Bolivian specimen of *A. trichodermatum* may reflect that the specimen was immature when collected and the skeletobinding hyphae where not properly developed (a situation that is well known in *Polyporus squamosus* Ryvarden pers obs.). However the monomitic structure is also observed in the type specimen (Figure 10). This monomitic hyphal system suggests that *A. trichodermatum* could be related to *Amauroderma brasiliensis*

Figures 1–8. Macroscopic features of *Amauroderma trichodermatum* (**1–7:** *L. Evans 74* LPB, **8:** holotype SP 102864). **1:** general view *in situ.* **2:** close up of pilear surface. **3:** general view of the pore surface. **4:** general view of dried specimen. **5:** longitudinal section of the pileus showing tube layer, context and hairs of the pileus. **6:** longitudinal section of the stipe showing context with resinous bands and the tomentose surface. **7–8:** close up of the longitudinal sections of the pilei showing detail of the trichoderm-like hairs. **1–3:** Photos by D. Newman.



Figures 9–15. Microscopic features of *Amauroderma trichodermatum* (**9–10:** holotype SP 102864; **11–15:** *L. Evans 74* LPB). **9:** basidiospores, white arrow indicates the prominent apiculus. **10:** monomitic structure of the context showing clamped hyphae. **11:** monomitic structure of the context showing clamped hyphae, white arrow indicates a collapsed portion. **12:** section of the pilear cover showing a hair-like element. **13:** detail of the monomitic structure of the hair-like element. **14:** section of the stipe showing one of the hairs of the tomentum. **15:** detail of the structure of the tomentum composed by generative hyphae, black arrows indicate clamps.

(Singer) Ryvarden, another distinctive species in the genus, though there are some significant micro and macromorphological differences. The pileus surface of *A. brasiliensis* is glabrous, whitish and papery. Microscopically, while *A. brasiliensis* and *A. trichodermatatum* share the same dominance of generative hyphae, *A. brasiliensis* has, in addition, some scattered skeletal hyphae (Ryvarden 2004). Basidiospores of *A. brasiliensis* are similar in shape and size to those of *A. trichodermatum*.

The monomitic hyphal system is a deviating character in *Amauroderma*, in which most species have a dimitic hyphal system with skeletobinding hyphae dominating in the basidiome. Molecular phylogenetic analysis would be helpful in determining the relationship between these species and also within the genus.

Figure 16. Distribution map of *Amauroderma trichodermatum* based on known records (Table 1). Main Eco-regions of America are shown based on Robledo et al. (2014). Shaded area (blue line) indicates the potential distribution area in South America (see discussion in the text).

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Authors' contribution statement: All the authors have contributed equally in to improving the text, discussion on morphology, nomenclature, and establishing the distribution of the species; in particular, DN collected the Bolivian specimen and conducted field photography, and GR carried out macro- and microscopical analysis.

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